QUESTION 3 (6 marks)

Figure 1 shows rhombus $OPQR$ with $\overrightarrow{OP} = \boldsymbol{p}$ and $\overrightarrow{OR} = \boldsymbol{r}$.
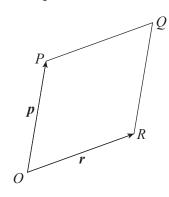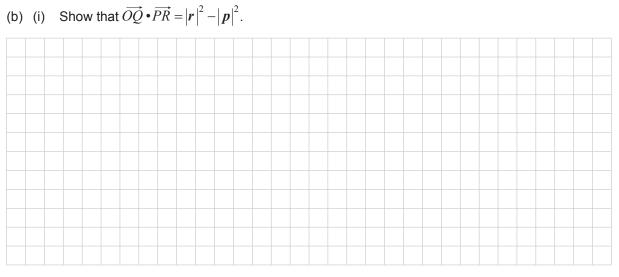

Figure 1

(a) (i) Find $\overrightarrow{OQ}$ in terms of $\boldsymbol{p}$ and $\boldsymbol{r}$.

(1 mark)

(ii) Find $\overrightarrow{PR}$ in terms of $\boldsymbol{p}$ and $\boldsymbol{r}$.

(1 mark)

(b) (i) Show that $\overrightarrow{OQ} \bullet \overrightarrow{PR} = |\boldsymbol{r}|^2 - |\boldsymbol{p}|^2$.

(2 marks)

(ii) Hence prove that the diagonals of the rhombus $OPQR$ are perpendicular, giving reasons.

(2 marks)